Increase the feedback in IoT development in Node-RED - *Quasi-Experiment*

Node-RED is one of the most widespread VPLs targeting IoT systems that mashups hardware devices, APIs, and third-party services, in a hybrid text-visual programming approach. With Node-RED, it is possible to create flows with the aim of composing some rules that the system has to comply with. These flows can be something like turning on the coffee-machine whenever the user wakes up, turning on the heating system when the user is returning home after work, turning on the A/C if the temperature rises above a certain level, and many other examples.

So, let's begin with a tutorial in order to become familiar with the tools that will be used in the next set of tasks.

Tutorial

Task 1

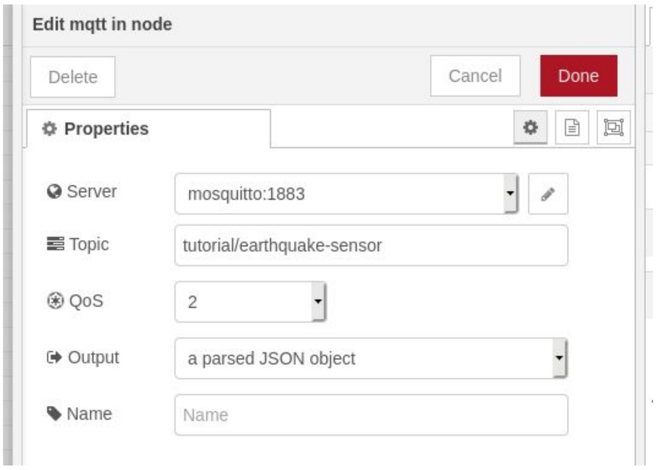
This task is similar to a "Hello World" where Node-RED is introduced alongside some basic concepts by creating a flow that demonstrates the Inject, Debug and Function nodes.

1. Go to http://nodered-feedback.com/nodered where the tool is running.
2. Go to https://nodered.org/docs/tutorials/first-flow and proceed with the tutorial skipping the first step.

Task 2

This task will introduce a flow based on data from an earthquake sensor to do something useful. Also, it will introduce four new nodes (MQTT in, MQTT out, Switch and Change) that will be useful in further experiments. Finally, it will use a simulator to start and validate the final flow.

1. Add an MQTT IN node, click on it to see further information and edit as follow:



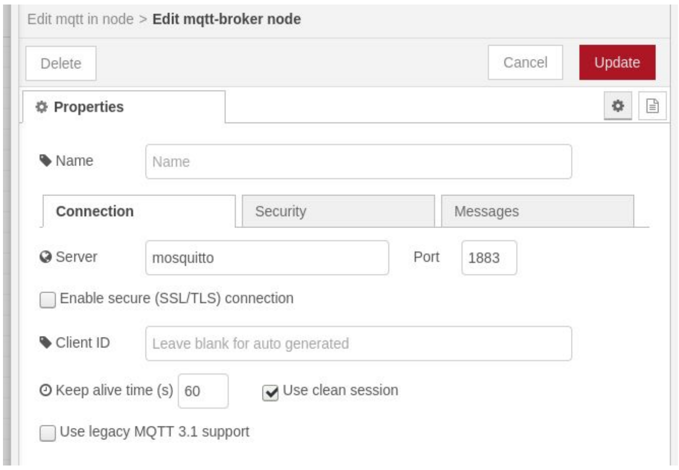
Server: mosquitto:1883

Topic: tutorial/earthquake-sensor

QoS: 2

Output: a parsed JSON object

Name: Name



Name: Name

Server: mosquitto Port: 1883

☐ Enable secure (SSL/TLS) connection

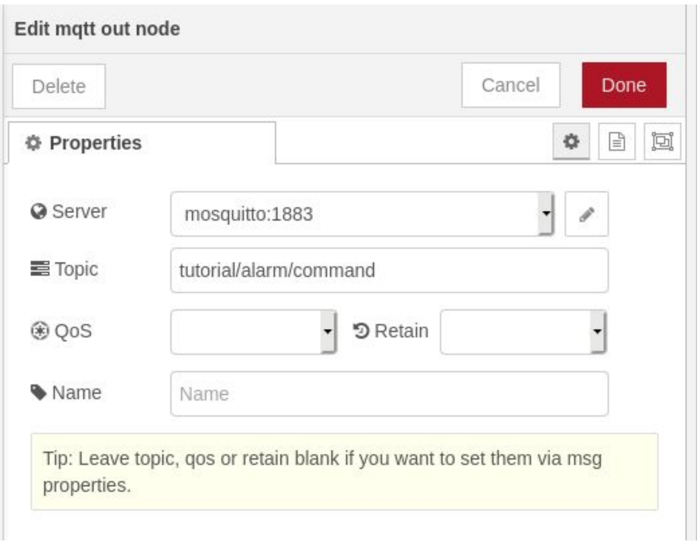
Client ID: Leave blank for auto generated

Keep alive time (s): 60 ☑ Use clean session

☐ Use legacy MQTT 3.1 support

More information about MQTT.

2. Add a Debug node to the output.
3. Add a Switch node to the workspace. Edit its properties and configure it to check the property msg.payload.mag with a test of >= change it to test on a number and the value 7. Click Done to close and add a second wire from the MQTT IN node to this Switch node.
4. Add a Change node, wired to the output of the Switch node. Configure it to set msg.payload to the string ON.
5. Wire a new Debug node to the output of the Change node.
6. Wire a new MQTT out node to the output of the Change node with the following configuration:



Server: mosquitto:1883

Topic: tutorial/alarm/command

QoS:

Retain:

Name: Name

Tip: Leave topic, qos or retain blank if you want to set them via msg properties.

7. Deploy the flow to the runtime by clicking the Deploy button.
8. Open the browser and type: http://nodered-feedback.com/validation
9. Click on Tutorial -> Test1 -> Start.

If it returns true, it means that the flow works as expected. Furthermore, in the Debug sidebar you should see a list of entries with some contents that look like:

```
msg.payload : Object
{"time":"2017-11-19T15:09:03.120Z","latitude":-
21.5167,"longitude":168.5426,"depth":14.19,"mag":6.6,"magType":"mww","gap":21,"dmin":0.478,"rms":0
.86,"net":"us","id":"us2000brgk","updated":"2017-11-19T17:10:58.449Z","place":"68km E of Tadine,
New
Caledonia","type":"earthquake","horizontalError":6.2,"depthError":2.8,"magError":0.037,"magNst":72
,"status":"reviewed","locationSource":"us","magSource":"us"}
```

You can now click on the little arrow to the left of each property to expand them and examine the contents. Also, if there were any quakes with a magnitude greater than 7 you will also see debug messages like:

```
msg.payload : string(2)
"ON"
```

You could change the switch value of 7 to a smaller one to test your program. Remember to click on deploy after the change. ***

Summary

This flow is triggered externally through an HTTP Request and retrieves data from a queue. It parses the data and displays it in the Debug sidebar. It also checks the magnitude value in the data and branches the flow for any messages with a magnitude greater than, or equal to, 7. The payloads of such messages are modified, displayed in the Debug sidebar and send a command to trigger the alarm.

NOTE: This tutorial is based on the Second-Flow tutorial from Node-RED.

Useful Resources

- Node-RED Documentation
- Node-RED Tutorials
- Node-RED Core Nodes Guide

Some Tips

Q: How to not overload a certain device? By overload, it means receiving messages at a higher rate.
A1: Using a Delay node configured to rate-limit the messages passing through it (Slow down messages passing through a flow).
A2: Using the same node but configured to rate-limit the messages passing through it with the option to drop intermediate messages enabled (Handle messages at a regular rate).

Q: How to not overload the device by constantly sending the same command?
A: Using a RBE node configured to send a message only when the value changed (Drop messages that have not changed value).

Q: How to not incessantly turn on/off a device when receiving slightly differences in data readings?
A1: Using a RBE node configured to only send a message if respect a certain threshold (e.g., check if our input data has changed by more than 20%).

Q: What can I do to automate my home?
A: 25 Home Automation Ideas: Ultimate Smart Home Tour!.

Note: Open http://nodered-feedback.com/docs/validation/list_devices.pdf to see what topics subscribe and the respective payload.

Task 1

John Doe has developed a system capable of automating the treatment of a strawberry plantation inside a greenhouse. However, strawberries require some special care such as:

- Exposure to sunlight;
- The soil pH must be contained between 5.5 to 7;
- Absence of wind;
- Temperature between 20-23 ºC;
- Humidity above 70%.

Currently, the system is capable of:

- To keep the soil moisture close to 75%. Through a humidity-temperature sensor that communicates its values periodically and if they are lower than expected, the irrigation system is switched on at 10 p.m. until these values are reached;

- To maintain the temperature through the heating system. This system is switched on if the temperature is below 20 ºC until it reaches a temperature of 23ºC. This heating system only receives values with a difference of 1ºC. And when it turns on, it automatically closes the windows if they are open.

Task 1a

John Doe has had huge headaches with the heating system that has constantly been damaged due to on / off too many times in a short period of time. And, he also noticed that other parts related to this system have not worked properly.
Identify and fix bugs.

Download and import: http://nodered-feedback.com/validation/flows/agriculture1.json

Task 1b

Strawberries need to have sunlight daily. Implement a feature that, based on weather forecasts, turns on / off the UV lamps according to whether or not the sun is present.

Task 2

Now implement a system for a smart-home with 3 basic features:

- If it's sunny outside, open the blinds;
- If there is movement in the kitchen, turn on the lights only if there is not enough light (less than 50).
- Every day at 6 a.m., turn on the water heater.